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Research QuickTakes Volume 3:
The Hearing Aid Fitting Process - Getting It Right
Presenter: Brian Taylor, AuD; H. Gustav Mueller, PhD

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What Are Hearing Aid Users Telling Us?

- [Brian] Hi everybody, and welcome back to another edition of Research Quick Takes. We are now on Volume 3. Hopefully you've been able to see Volume 1 and Volume 2. And in Volume 3, this time we're gonna be talking about the hearing aid fitting process and getting it right. And for our first episode of Volume 3, we're gonna be talking about the voice of the consumer, or what hearing aid users are telling us about their experience. And with us today, as usual, is Gus Mueller. Welcome back, Gus.

- [Gus] Yeah, yeah, yeah! Thank you. It's been a while. I think it was a month, or so ago, when we wrapped up Volume 2. How were the reviews on that doing? Do you know? Have they've been rolling in? Or, what do you hear?

- [Brian] We've had a few roll in. We've had several students that have watched our first two versions of Quick Takes.

- [Gus] Oh, yeah? Great. Great.

- [Brian] I think they've only been posted on Signia Live for a few months.

- [Gus] Oh, okay. Well, we'll just keep rolling along. And yeah, I'm looking forward to this, Volume 3, I think. I'm not too sure where it's gonna end, but I sort of see a path that we're gonna talk about everything we can think of to get the hearing aid fitting right. As you mentioned, starting things off here, just last year, there was, at least, three different retrospective studies that were published. Where they tried to look into what is impacting adoption of hearing aids, acceptance. And perhaps, more importantly, what's impacting benefit and satisfaction. And so, we'll be rolling through three of these studies, and seeing what we can learn. The first one, many of you listeners are probably familiar with this particular website.

Originally launched by Abram Bailey, about 10 years ago, or so. And there's other people working there now, but I think Abram is still the main honcho. And this is basically a consumer website. And providing consumers with a lot of information. But also, it's where consumers can write in comments about the hearing aids that they like, or that they don't like. How are things going. And it's sort of just for general discussion for consumers. And so, what a group of audiologists did is, they took a look at the reviews that had come in from the years 2013 to 2019. And they did a specific kind of analysis with these reviews, which we'll get to in just a moment. As you can see there, bullet, the second one down.

Most of the consumers were fitted bilaterally. That's probably higher than the national average. But that probably speaks something about the kinds of people who go to these websites. They had various amounts of experience. Two thirds of 'em indicated they owned the highest level of technology. Of course, we don't know if that's really true or not. Again, that sounds a little higher than average. And the majority of them were overall satisfied with their hearing aids. Giving it a very good, or a good. You know, we've talked about MarkeTrak in the past, Brian. And I think when we look at overall satisfaction, 85%, or something, I don't know. Do you remember what it is for MarkeTrak?

- [Brian] Yeah, I think. Well, it depends a little bit on the specific situation a person is in. But overall satisfaction is over 80%, and it has been for the last couple of years.

- [Gus] Yeah. And I know, on inquiry, for example, I think it's 92%, or something. But this was just general questions on satisfaction. And so, I think, you know, it sounds like it's a pretty typical group that they're looking at. So what they did is, there's software available that you actually go through and scan all the words in these comments. And then, based on that, the software identifies themes, domains, and clusters. And so, what we're gonna talk about today is the two domains that were identified. And so,

these were two specific areas where these clusters fell into. So the first one, which you see here, is called device acquisition. And that was just a little over half of all the comments related to device acquisition.

And what you see, this is percent of totals, okay? So this is a percentage of 52%. Well, they'll all add up to 52%. But we'll get to the second, device use, Anyway, of this particular domain, physical fit and device management, was number one, followed by finding the right price. And I'm not sure about the one on the top, their aid to suit hearing. I guess people questioned whether they bought the right hearing aid is my guess. And then that showed up in this analysis. The second domain is actually using the hearing aids. To no one's surprise, the number one on this list, hearing in noise at about 23%. So that's 23% of 100%. So that means about one fourth of the people who commented on something, what they commented on was their ability to hear in background noise.

And, you know, for those of us who've been around a while, we know that that's going to be the case. The other two things that fall into this category, that is, using the smartphone app, adjusting the hearing aid with the smartphone app. And streaming, which is running around 14%, it looks like. The one thing that immediately came to my mind, and Brian, I don't know your thoughts on this. But if you remember back in the beginning, I mentioned that these were collected from 2013 to 2019. When you think of what's happened in the past three years, relative to app adjustment and streaming, I'm betting that in 2022, these percentages might be higher. What do you think?

- [Brian] Yeah, I think you're right. I mean, back in 2013, 2015, very few hearing aids, if any, had an app that used to adjust it. And we start smartphones streaming. And even in 2018, 2019, not every hearing aid had those features on them. So I'm betting if you were collecting data today, those bars would be closer to the hearing and noise bar on the bottom.

- [Gus] I would bet if you asked the average dispensing audiologist, when a patient walks in the door unexpectedly. Or calls you, other than a plugged receiver, what's their topic of discussion? I would bet it falls into something to do with smartphones, and streaming, and that kind of thing. It's just a guess.

- [Brian] I think you're right.

- [Gus] And for those of you who are curious about this whole analysis, how it works, the authors actually gave you. This is now listed, in order, of how often it showed up. So, in other words, for the category of, on the top, their right provider, device, and price point. The number one words that were pulled out that created this particular cluster. Cluster, where the words cost, Costco, return, price, warranty, you can look down on the list. I think, you know, it only makes sense if you go down to number four, smartphone streaming. The words that were pulled out were phone, call, stream, Bluetooth, connect, music. So that's sort of how this thing works. The software goes through and tries to find similarities, patterns, and does grouping.

I'm thinking, you'll probably see some more of this. It's an interesting way to analyze consumer behavior. All right, let's move on to another one. I think back in Volume 2, Brian, I think we talked about some work that Larry Humes had done, relative to the HHIE. This is another publication of his. This, again, was from last year. And what Larry did in this is, went back through some studies that he had done in the past, because they'd done a lot of measures on these people. And what he was looking at is, in a couple of those studies, relative to people who, through the experimental design, had been fitted with hearing aids. And then at the end, they had the opportunity, "Do you want to keep your hearing aids?" Or, "Do you want to return them, and we'll give you your money back?"

And so, he's calling these adherents versus non-adherents. And so, what you see here is the unaided measures that were conducted on all of these. Nothing unusual there. A scale that most of you are not familiar with is the communication profile of hearing impairment. It's an excellent scale, but it's quite long. And developed in the 1980s. Walter Reed, I might add, when I was there. Although, I didn't work with it. But it's not commonly used, but obviously Larry used it. And I think there was a couple results that were pulled from the CPHI data. The other tests are the ECHO, that's the Robyn Cox test of expectations.

The Glasgow Benefit Scale is used in a lot of research. And, of course, we have the good old ANL. That is, how much does noise bother you? After these people were all using their hearing aids, they came back, and they received some outcome measures. The happy is not used much anymore. That also was developed at Walter Reed by Brian Walden back in the 1980s. But it's a test of benefit. And then Robyn Cox developed the SADL. That's number two. We got the Glasgow Benefit again. And then they used satisfaction scale, similar to what's used at MarkeTrak. And they used Robyn Cox's Connected Speech Test. So all of these were done then afterwards. And the question, which is down in the bottom there, is what we really want to know is, what was different?

80% of the people said, "Yes, I want to keep my hearing aids." 20% said no. Could we have predicted, based on the data collected, who was gonna fall into that category? The answer is maybe. Here's what didn't have an effect. Educational level, income level, or duration of hearing loss. There also was no difference between groups for the unaided ANL or speech recognition. The adherents had greater hearing loss. That makes sense. And so now, we get down into some interesting things. I'm now down on bullet point number four. The non-adherents showed lower expectations. So this was something from the ECHO. So their expectations weren't as high. Now, I would say, if their expectations are low, it should have been easier to satisfy them.

You know, normally, you sort of like somebody with low expectations. But anyway, that's the way it turned out. The non-adherents also reported better communication performance and better adjustment to hearing problems. Except, they had poor awareness of their performance problems. And they had more denial. So, I think it's these later things that they didn't really realize how bad they were performing, and they didn't really probably believe they had much of a hearing loss to begin with. And not surprisingly, for the benefit scales and the satisfaction scale, the adherents were significantly more benefit and satisfaction.

- [Brian] I think this is a really interesting study, in the sense that it's the variables that the audiologist, or the hearing care provider, can kind of shape with counseling, that seem to make a difference. The ones that you measure objectively don't make much of a difference. But things like expectations and awareness, those are things that you have control of in your clinic. So I thought that was kind of an interesting finding.

- [Gus] Yeah, and again, the CPHI is a really long test, and nobody seems to use it, but that one bullet point there where we're talking about awareness of their communication problems, denial, communicate, all that came off the CPHI. That's how we gathered that. Now, you could probably, you know, you could probably pull it out in some other way, but sometimes it's nice to have a structured way to do it. Well, that was the end of that one. And we're moving on to our third study of this particular episode. And I'm thinking it has something to do with Wisconsin. Or, I don't know if this is your favorite logo, but I do recognize this guy. People just wanna know, how much had you had to drink before you put that up? I would hope it was at least a six pack.

- [Brian] Oh, those of us in the know in Wisconsin know that you don't have to drink anything to put on your cheese regalia.

- [Gus] Well, nice to know that you are indeed a cheese head. Of course, where we're going with this, is to this place called Beaver Dam, Wisconsin. And some of you may be familiar with Beaver, the Beaver Dam research that went on way back, and started way back in the 1990s, I think. And Brian, actually, the reason we have that first slide there is, you indeed are from Wisconsin, but not from Beaver Dam. Are you?

- [Brian] No, that's the southern part of the state. I'm from the northern part, which isn't even on this map.

- [Gus] Not on the map. So, are you close to Minnesota then?

- [Brian] Yeah, I'm on the left. If you were on the left corner of this map, and went up of another four or five inches, you would be where I grew up, a little town called Holton, Wisconsin.

- [Gus] Okay, well, good. Good. Well, since you know everything there is to know about Wisconsin, why don't you tell about this study?

- [Brian] I do know a little bit about the Beaver Dam studies, and I think they were done back in the 90s. And there's studies that looked at overall health of people over a long period of time. So it's a longitudinal study. And there were researchers from the University of Wisconsin that conducted a number of these studies. And I know hearing loss, and the prevalence of hearing loss, was a big part of those Beaver Dam studies. But it wasn't the only thing that they looked at.

Anyway, you might notice in the title of this study that it was published in 2021, that it's an offspring study. Which means that it's people that were the offspring of the original Beaver Dam study participants. And you can see that there were about 4,500 eligible people. 82% of them that participated, and the average age, was just over 65 years

old. And the whole idea here is to kind of look at hearing loss, and vision, and, I guess, olfaction in children, over a period of about 10 years. Is that right, Gus?

- [Gus] Yeah. Yeah, I think so. I have to tell you one little sideline here. We were doing a presentation for the Academy, and Ryan McCreery thought that it was sort of funny. He pulled up a picture of the band Offspring, which, of course, everybody thought was sort of funny, except me, 'cause I'd never heard of the band Offspring.

- [Brian] Yeah, you gotta be probably.

- [Gus] I don't know. I guess they're popular, huh? It seemed like everybody else knew the band Offspring.

- [Brian] Well, in this offspring study that was published last year, they included 579 adults, and they had a high frequency pure-tone average. So it's mild. A mild hearing loss. And most of the participants were in middle age, between 45 and 65. And you can see in the study, in addition to measuring their thresholds, they looked at word recognition measures in quiet and in noise. And they also administered a few questionnaires. And this is what they found. They found that only over that 10 year period that only 12% of that group actually adopted hearing aids. And some of the factors that were associated with adoption of hearing aids are listed here on the slide. People that had a higher education. People that had more high-frequency hearing loss.

People that self-reported hearing handicap on the HHIE. And kind of interesting, people that answered yes to the question, do friends and relatives think that you have a hearing problem? Things that didn't make a difference were word recognition scores and noise. That wasn't significantly associated with adoption of hearing aids. And I think what you have to keep in mind. I know what your thoughts are on this, Gus. But,

you know, we're looking at people that have relatively mild hearing loss, especially compared to those that we typically see in the clinic.

- [Gus] Yeah. I don't know a lot of data that we have. Probably MarkeTrak does, on the adoption rate for people with this mild hearing loss. I think I remember it being in various clusters over the years. I don't know if it's been.

- [Brian] Yeah, it's about 10%. I think the consensus, there's a few studies that have looked at that. It's around 10% of people in the mild category, mild high frequency, that adopt hearing aids.

- [Gus] Yeah. So they're right on target here. The one thing that I also found interesting with this is that there's some other studies that have looked at benefit with people. Now, this is different than people who adopted hearing aids. This was looking at all the people who adopted, and looked at who was obtaining the most benefit. In fact, there was just a systematic review of that published last year. And interest for that, speech and noise testing, actually predicted benefit. Not surprising. But speech and noise doesn't seem to predict adoption. But again, it could be that these people just had pretty normal hearing, and their speech and noise scores were all clustered at the top. And that maybe is why.

- [Brian] But I, again, sort of like that Larry Humes study. I think the interesting thing here is it's more about the perception of the person.

- [Gus] Right.

- [Brian] Than it is any kind of objective measure, or even a subjective measure in the clinic. It's more about what the patient believes, or thinks their problem might be.

- [Gus] You know, the authors mentioned something that I don't think is on this slide. And I'm not entirely sure what they meant, but they said that was interesting that it was significantly correlated with, do friends and relatives think you have a hearing problem? Okay? But it was not correlated with, do you think you have a hearing loss? See, so people are, like, blaming somebody else. "Well, they think I have a hearing problem, but I'm really okay." So that's sort of interesting. And that's it. Any closing words?

- [Brian] No. I think it's interesting that we're starting to see more and more studies like this. You know, back to their first one that you shared with us. I know that group has got at least two or three others that are similar, where they use keyword searches.

- [Gus] Right.

- [Brian] Machine learning to kind of pull things out of computer reviews. So I think, you know, we're gonna see more of these things that are pretty interesting clinically.

- [Gus] Yeah. I think, you know, when you see all these new companies trying to hit the direct to consumer market, these are probably the very studies that they wanna look at to say, how do we market these things, and what's our target group, and all that. So it'll be interesting down the road.

- [Brian] Exactly. All right, well, I guess our time is up. So we'll see you next time for 3.2.

- [Gus] 3.2. Can hardly wait. See you later.

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Does the Level of Technology Matter?

- Welcome back to another addition of Research Quick Takes. I'm Brian Taylor, and we're on Research Quick Takes 3.2, the Hearing Aid Fitting Process and Getting it Right. And in addition too, we're gonna talk about does the level of technology matter? And with us as usual is Dr. Gus Mueller. Welcome, Gus.

- Thank you, thank you. Good to be back, and I'm gettin' excited about this volume two thing. So we're on episode two here, and I guess today, we're gonna be talking about technology, and we'll see where we go from there.

- Exactly.

- Since I got just one or two years on you age-wise here, when we're putting this little talk together, I was thinking about the comparative stuff that was done in the old days. Well, by old days, I mean 30 years ago, and I remember when Mead Killion came out with wide dynamic range compression, and everybody was, "Is that really better than analog?" And every university was doing a study of analog versus wide dynamic range compression. Now, were you fitting hearing aids back in, that would've been 30 years ago?

- Yeah, this was the very beginning of my career, and back then, WDRC was a really big deal. The fact that you didn't always, you had got more gain for soft, and I think there's some real advantages to that.

- Yeah, it's interesting, and, of course now, try to find a hearing aid that doesn't have WDRC or that isn't fitted with WDRC. I mean, you could move the need points way up, I guess, on some products, but it's just become standard, which takes us into another one that was real interesting. I was actually selling hearing aids, this is while I was in private practice, and there was a big battle. In fact, we used it for marketing about, 'cause we now had hearing aids with two channels, not just one, but we had two. And

then, of course, Siemens came out with the three channel hearing aid, and the war was on. Everybody had, "We have more channels than you," and then pretty soon, you saw four, and then there was eight, and then 16, and now there's a quadrillion or something.

- Yeah, triple digits at least I think.

- Yeah, it's amazing, but this was a big deal. In fact, there was a lotta research comparing two versus four, four versus eight, and all that. Interesting thing on all that research, pretty much everybody concluded that eight was enough, but that didn't stop anybody from keeping on going of course. And then, of course, when digital processing came out, it was, "Is digital better than analog?" And there was study after study on that. So, it's interesting. Today, and by today, I mean the last 10 years or so, what has been the popular thing to compare is to look at levels of technology. Because manufacturers like to roll out their products in sort of a good, better, and best, and many healthcare professionals, hearing care professionals, sell their products.

They display them, talk about them, in sort of the same way as a good, better, best. So it's only logical, I think, that researchers wanna take a look at this. The best, the one that gained a lot of popularity and was very well designed and funded by the VA. You could see why the VA might be interested in this because they're spending millions of dollars on hearing aids, and what if the entry level was just as good as premier? How much money wouldn't they save in a year? That's a big deal, right. So anyway, Robyn and her colleagues at University of Memphis designed this study, and the biggest difference between the premier and the basic was that the premier had 16 channels, the basic only had eight.

And then the premier also had some more sophisticated noise reduction. Both the premier and basic, both did have directional microphone technology. What made her

study unique is that she not only used premier versus basic, but she did it from two different manufacturers, Siemens and Phonak to be exact. And so, you had premier/basic from Siemens, premier/basic from Phonak. So that's why what you'll see here is, labeling on these charts, which hopefully you can read, you have basic A, basic B premium A, premium B, and so, that's the basic and premier from Siemens, basic and premier from Phonak. You might wanna ask me who's who, but it doesn't matter, because they all turned out the same.

- Well, you can tell by the lines that there's no difference, on the bars I should say.

- Yeah, I mean, even if you got a C- in statistics, I think you could figure this one out. Pattern recognition.

- It didn't matter. It didn't matter what company, and it didn't matter whether it was basic or premier. The only thing that did happen, thank goodness, is that people did better than unaided. Well, a second study then, similar to this, came from Wu and his colleagues at University of Iowa. I suspect Ruth Bentler was maybe involved in this too. And so their study was a little different, and they looked at two different things. They looked at having features on versus off to see if there's actually research evidence that features work. By features, I mean directional and noise reduction, but then they also looked at premier versus basic. And the third thing that made theirs a little unique is they used something that Wu has worked a lot on over the years, and that's called ecological momentary assessment.

And that means it's sort of an on-the-spot rating of how people are doing, and this was actually handled a couple different ways. One of the ways is just randomly, people would get a question on their cell phone that they had to answer at a given point in time. "How are you doing right now?" Or, "Are you in noise?" And all these kinda things, so the the notion there, it's a much better way to sample real world preferences.

Well, here are the results. This turned out as you would think and as you would hope. They had three tests in the lab and four tests in the real world, for all of them, there was a significantly better for features on.

The only time it was the same was for listening effort in the real world, and there was no condition where features off was the winner. Now, if we look at basic versus premium, the only time that premium was better was for speech understanding in the lab. That could be because the premium had, I believe, slightly better directionality. If you look at sound quality, listening effort in the lab, and all the tests in the real world, there was no difference between premium and basic. So basically, it turned out the same as the Robyn Cox study, which takes us to the latest study. Well, I don't know, there might be one since then, but these are two studies that were just published last year.

And this is from the University of Tennessee. Patrick Plyler I know was on both studies, and that's the name that immediately comes to mind. I don't think I have the reference here, but it'd be easy to look up, look up Plyler, P-L-Y-L-E-R.

- You're exactly right. He's the lead author on both these studies.

- Only on one I think, but.

- [Brian] Oh really?

- But he's the second author on one, and anyway, you can find it, if you just Google Patrick Plyler. Okay, so what did they do? Again, this was a similar thing where they had levels of technology. This was actually a hearing aid, where you could, through the software, you could change the level of technology, called Flex Technology. And so what we have here are the tests that were done. The reason there's two studies is one

was with experienced users, one was with new users. Because it's at University of Tennessee, of course, they're gonna do the ANL test, and they did. Then they had two different speech and noise tests, which was a nice way to look at their listening demands.

They looked at everybody's data logging to see what percent of time they were in background noise. They had listener preference, and they had a self-report questionnaire, the SSQ12, which is just a shortened version of the original SSQ. So for both groups, meaning in both studies, the results were very similar. People who preferred premium, there was two things. One is they had a larger ANL. Larger is bad for the ANL, meaning that people were bothered by noise at an earlier point in the SNR. And the people who preferred premium also spent more time in speech and noise listening situations. Not too surprising. Both groups had a preference, but it was the highest for the new hearing aid users, 74%.

Now one thing that was in their data but they didn't talk about, but it was on a table that I pulled out specifically for this chart that I found interesting is on this particular scale up is bad 'cause that's the SNR where people are getting 50% correct. And what you see there is the people who preferred premium, and it didn't matter, if they were tested with the premium or if they were tested with basic, the people who preferred premium had a significantly worse performance in background noise. And I don't have a real good reason for that. Brian, anything come to mind? We're looking at a four db difference. That's, this is a mean, of course, but that's a pretty big difference.

- It's really interesting. I think it has somethin' to do with people that preferred basic, their QuickSIN scores are lower. They basically just need audibility restored, and they do better versus people with premium, I think they just need, they benefit more maybe from all of the noise reduction technology that's available on a premium. I mean, it's hard. It's an interesting finding, but I really don't exactly know what.

- Yeah, well, if you look at QuickSIN norms, I think normal is usually considered zero to three for SNR loss, and these people are only at around four or five. So, it could be that they can sorta get by in noise anywhere anyway, and they didn't really notice the benefit of the more advanced directionality. I don't know, that's a guess, but certainly, as a clinician, if you're trying to guide a person one direction than the other and they're on the fence or you need documentation, it certainly would suggest that the worst their QuickSIN score is, the more you would encourage them to get the highest level of processing. Does that make sense to you Brian?

- It does, I think this is just evidence to say, to tell a story about premium is probably the direction you wanna go, if your measured SNR loss is greater than eight or nine.

- Okay, one more to go. This was also just published last year, and this is from the folks in Western University in London, Ontario, the DSL folks. And again, they looked at various measures, pretty much the same that have been used before, but they had something different. And that is, in addition to all that, they did something called concept mapping, and that was what they used to investigate preference results. The participants generated statements as what they liked or what they didn't like, what influenced their benefit. These were all analyzed and then sorted into themes. They actually came up with nine different themes, then they went back and they took these nine themes, and they had all the participants rate how important that particular theme was to them on a one to five scale.

So if somebody said, "Well, the reason I like this was because I understood in background noise," then that might be one of the themes. It wasn't though, by the way, 'cause the themes are a little more general than that. But, so here's what they found out. Just like all the other studies, in the laboratory testing, they found no difference between premium for sentence recognition in noise, consonants, or speech quality. But

what they did find is after this field trial, 83% preferred the premium technology, and not only preferred it, but half of those had a strong preference. So as I mentioned, they had nine clusters, and interestingly, the clusters that were rated the highest for both groups were sound quality, comfort and appearance, and ease of use.

Now, on the surface you might say, "Well, if those were rated the same, then why did most everybody like the premium?" Well, there's a very good reason. So let's look at why was there this high preference for the premium product. Here's the clusters that differed in their importance ratings. The people who preferred premium gave much higher ratings to having access to smartphone application, having the ability to stream calls and music, and other convenience features that had accessory compatibility. And so, what we're seeing, and I think this is happening more and more, is what's separating basic from premium might not be the best directional microphone technology or the best noise reduction or the best feedback reduction because maybe those are all on the basic product. And so, you get to the point is what is going to differentiate basic from premium? Fortunately, in our midst today, ladies and gentlemen, we have somebody who works for a hearing aid company.

- Well, this is a real challenge. Well, my thoughts are, to your point, I think that some of these accessories are a difference maker and would have somebody more likely to prefer premium over basic. But I think the challenge now is a lotta the things you see on this slide, smartphone apps, the ability to stream, that's found across the product line, so even this difference between basic and premium is blurred more now than it was when this study was conducted four or five years ago. So I think the little nugget of information that I would take from what you just talked about, Gus, was from the Plyler studies, where they showed that people that did worse on the QuickSIN had a stronger preference for premium.

To me, that's one of those things I would use in the clinic to maybe encourage somebody more strongly that has a poor QuickSIN score to maybe go with the premium technology because there's some data there that would suggest they're more likely to prefer it. But it's a challenge, because you look at good, better, best on paper, the differences are pretty subtle. And it's all about what's most likely to be beneficial to the patient, and I think, based on some of the things you shared with us around performance unaided and noise, maybe lean towards premium in situations where you're seeing a poor score on the QuickSIN. Or for those that do the ANL, same thing.

- Well, and the thing with these, we're reviewing publications, is that things change so rapidly. I mean, these are articles that were published in 2021, which tells me the research was maybe done in 2019 or so, 'cause it takes a while to analyze the data and go through the publication process and stand in line to wait to get your paper published and all this. So what was the premier hearing aid in 2019 is the intermediate or basic product today.

- Exactly.

- [Gus] Things just keep changing.

- But technology's always improving, and I think down the road, you're gonna probably see hearing aids at the premium level that are probably able to pick out certain voices that a person wants to hear better than maybe basic or mid-level technology. So, that mattress slide you showed before, instead of numbers of channels, it might be just the sophistication of the machine learning algorithm or something like that, so.

- Exactly.

- [Brian] Always something new.

- It's an interesting topic, and we'll have somethin' to talk about next year, 'cause it's never ending.

- [Brian] Exactly.

- It continues all time.

- We'll see you next time for 3.3.

- Sounds good.

- [Brian] Bye.

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A Patient-Centered Approach

- Welcome back, everyone to another edition of Research Quick Takes. We're on episode 3.3, the hearing aid fitting process, getting it right and today we're gonna be talking about the patient-centered or a patient-centered approach. I'm Brian Taylor and with me as usual is Gus Mueller. Welcome, Gus.

- Hey, thank you, thank you. It's been a little while since we've been on and this is a fun topic. As most people know whether it's patient-centered or person-centered, I never know what's the most acceptable word. I think we're using patient-centered. Yeah, it's something we need to think about. And here's how we got to this topic if I'm remembering correctly. To give you all a review of Quick Takes 3.2, just in case it's been a while since you've watched it or read the article. We concluded at the end of that with a study that was done at Western University in London, Ontario, where they did concept mapping and very interesting stuff. They found out actually nine different areas that help drive hearing aid preference.

But number one, which is what we're gonna focus on for this episode and actually through the rest of this volume of Quick Takes. Is we learned, and I think we probably knew this, that sound quality and intelligibility is really what's most important. So when you think about sound quality and intelligibility, how do you get from point A to point B or how do you get from point A to point Z? So the starting point to me would be to look at fitting guidelines. And they've been around for a long time. I'm proud to say I was part of the the Vanderbilt/VA consensus statement. There were six of us who wrote that and that was 1991, so that's over 30 years old.

And then you have a lot of these other ones. Mike Valente has been real active and he helped write the ones for the academy and for the ASHA. Anyway, something's changed though in the last year. And what has changed is we now have a standard. Those other ones were guidelines. Now we have a standard from the APSO people, Audiology Practice Standard Organization. You might ask how is the standard different

from guidelines? Well, good question. And John Coverstone, who runs the whole APSO thing, has an answer for you. And this is for an article that he and I wrote together for 20Q. But I just pulled something out. So this isn't Gus talking, this is John Coverstone talking.

But I think I would say the same as he if I could. So his main point is a guideline, it's just something that guides you. And that's the purpose of it, to help you do a given task. The standard is really where those tasks are located and it tells you what you do for a particular circumstance. Two important things. If it's in the standard, there is assumption that that's what everybody is doing. And the second important thing is the standard is what is considered minimal acceptable practices. So what you do then is you take the standard and then you build a best practice document. So the standard itself is what would be considered minimal. And so we're gonna use this standard for our Quick Takes version today.

And then I'm pretty sure, Brian, I think, we'll pull some things off the standard as we walk through the rest of this whole volume. So this is just item number two from the standard saying that patient-centered and family-centered care should be provided. And further on about what we need to do with the patient. I pulled out something from the Institute of Medicine. They say providing care that is respectful of, responsive of, responsive to individual patient preferences, needs, values and so on. So that's the whole thing of patient-centered care, which has become a really big deal in medical care in general and also in audiology. So you ask yourself, you're a clinician and say, what can I do to help myself develop this patient-centered care?

And of course, the first thing that comes to mind is to use pre-fitting questionnaires. And I know Brian, you've written articles, book chapters about all these. You and I sat down and came up with three of them but do you remember how we decided or

- Well, I think these are probably the ones that are the most widely used, maybe the most popular, ones that have some research to support them. The way I think about patient or person-centered care is that rather than the professional sort of dictating what happens in the appointment, it's really about making sure you get the patient's point of view and including them in the process. And that's really what these inventories or these self reports or questionnaires are designed to do in somewhat of a rigorous, methodical way, is to get the patient's point of view in a way that you can quantify. And so the Hearing Handicapped Inventory, there's several different versions of that. Elderly, adults screening version.

There's actually a revised version that came out a couple of years ago here. Here's the list. The original HHIE was developed by Ventry and Weinstein in 1982, so it's more than 40 years old, and 25 questions. And the E stands for elderly, which some people don't like that term. But it's a questionnaire designed for people that are at the time at least 65 and older. Maybe today it's older than that, but you can contrast the HHIE with the HHIA, A for adults, questionnaire. Slightly different wording geared for people under the age of 65 that might be working. Then there's a-

- That's why I think there's only two questions that are different. Oh, and I might add-

- Well, you have them right here on the slide.

- The people who don't like the term elderly are the people who are over 65. The people who are 60 don't mind calling it elderly at all.

- Well, I think who was elderly in 1982 is different than who's elderly in 2022.

- Here you see the questions that are different.

- I'd like to think so, yeah. These are actually the questions, I sat down and looked at them all. And there's actually only two questions that are different. And the one says coworkers, clients, customers. So that's the HHIE, that's assuming the person's still working. Back in the 1980s, I think, they thought if you're 65, you're sitting in a rocking chair somewhere, listening to somebody whisper to you is my guess. And then the second one, which is sort of interesting. Does a hearing problem cause you to attend religious services less often? And they're thinking, "I don't know, if these young guys don't go to church at all."

- Yeah, old people go to church young people go to-

- We replace that one. I don't know, maybe they-

- Really doesn't matter, I don't think, which one you use. You might wanna use the revised version that I think-

- Yeah, that one... That article was published a couple years ago as I recall where they've merged them and can't remember how many questions there are on that.

- It may not be 25, it's around 25. But I know there is a screening version of that one as well.

- And I guess that's open access available someplace as I recall. I think it's in supplemental information with the journal article, if I remember right. Well, for those of you, most of you know the HHIE, I remember when I first went into private practice many years ago, one of my competitors put the HHIE on the side of a milk carton. Which isn't all that bad of an idea really. If you scored such and such or that, call da-da-da-da. I assume people have a milk carton sitting out on the table in the

morning and they're bored and they need something to do. Brian, I won't tell the story of you and the side of milk cartons 'cause we'll save that for...

- You had a good time and that's okay.

- We'll save that for another episode.

- They eventually found you and I'm happy to hear that.

- I'm here.

- So here's the norms. This is for the screening version is what you're seeing here. Zero and eight, no problem. 10 to 22, mild. And we've talked about before that this actually correlates similarly to Larry Humes' work, correlates nicely with people who adopt hearing aids, here's our HHIE score. Moving on then, this is a test that Robyn Cox developed. This test is actually part of the IHAFH fitting protocol, which I showed you earlier, the Independent Hearing Aid Fitting Forum. And so this was developed particularly for that particular case, and of course has become world popular. It is the most used self-assessment inventory in the world and is used in all kinds of research. 24 questions in 4 different categories. Ease of listening, which is listening and quiet reverberation, background noise and aversiveness.

Aversiveness is how much does a loud sound bother you? Those of you out there who'd like to start using the APHAB tomorrow, easy to do. You see the website down on the bottom of the screen, just click on applications. Once you're on applications, you click on APHAB and you get everything you need to know. You got the forms, the norms, here is questionnaire. Just to give you an idea of what that looks like, I labeled a couple things here. So background noise, when I'm in a crowded grocery store talking with the cashier I can follow the conversation. Each one of these four categories, there

would be six questions. Notice the patient can respond without hearing aids or with hearing aids.

So what we're talking about now is you're collecting information for your patient-centered care. So you'll have them fill it out without hearing aids. Now down the road, when they come back after using the hearing aids that you sold them, they'll complete it with hearing aids. You can calculate benefit and use that for your counseling. If we keep going with this whole series of talks, we may get to that someday. There's the norms. No reason to go through them now. Just wanted you to know that they are available, so you'll see what percentile your patient falls into. Which takes us to our last scale. This, by the way, Brian, I'm thinking you've written about this too. This is probably the most popular.

- Yeah, and I think-

- Fitting scale, right?

- Right, as great of a tool as the APHAB is I think one of the drawbacks is some of the questions may not be relatable to the individual. And so an alternative is to have a more open-ended scale. That's what the COSI is. I think the challenge with the COSI is you have don't have pre-packaged questions. So it takes a little bit of time for you and the patient to work together to create your own list. And that's what those blanks are there. There's a place for you to target five specific listening situations to target for improvement or to identify a problem and then target for improvement. You can write those down. And then you can see on the right hand side of this, where there's actually two different ratings.

On a one to five scale there's the degree of change between the unaided and aided and then there's the final ability. So slightly different variations of an outcome that's

measured on a scale. So this is a really handy tool in the clinic that I think a lot of our viewers are probably familiar with it if they don't-

- Yeah, and you mentioned it, which is true that it isn't like handing somebody a scale that already has the questions. But since our topic is patient-centered care, the fact that you have to sit with the patient and come up with these situations is actually, exactly what patient-centered care is all about. So the negative is actually a positive. I have to add one more thing. A year or so ago, Harvey Dillon, he got some award and very deserving so. And Karl Strom from Hearing Review wrote a little blurb about him and Karl started the whole thing off. And his lead thing of what Harvey Dillon has accomplished is he designed the COSI. And so I couldn't resist.

I sent an email to COSI and I said you might be the only person who's gotten an email to Dylan saying you might be the only person who's gotten an award for a blank sheet of paper. There's nothing on there. That's a good one.

- Hey, I got a new scale, it's blank. Yeah, I know, fill it out.

- Many times I tell clinicians just put it on a piece of paper. You don't even need to have this official document.

- Yeah, that's true. But that document is easy to download by the way. Just a couple of points here, Brian. You already explained all this but you want people to nominate situations. Usually, if you can get three that might be as good as you can get. When the person's all done nominating have them rank order them. And also some people will want to just nominate the most difficult situation they've been in, in the last year. You know they're probably never gonna be in that same situation again. So you sort of have to tone it down a little bit and say, "Okay George, I appreciate that. What kind of problem do you have just every day. I'm looking at your hearing loss.

I know you have a, do you hear your wife at dinner? Can you hear the TV? Can you hear," and on and on and on. And what you want are problems. It's okay to have a few stranger ones but you want some common ones. Here's a completed one. On this particular one, we actually also had the patient fill out their expectations, which can be sort of fun for when they come back to see if you actually met their expectations or not. As you can tell and this is real common, when we started talking the very first thing this person mentioned was hearing his friends while shooting pool. And why did he mention that? 'Cause it had just been the night before.

When we pushed him and pulled out stuff and we ended up with five of them that ended up being rank number five. Because it only happens once every two weeks or whatever the case may be. Now, I wanna say one thing, Brian. And and I have talked a lot about patient-centered care and I'm trying to take it to the next level. So when this patient said he was having trouble shooting pool in Ryder Bar, I actually made a site visit with my sound level meter just to see what the SNR was so that I could do appropriate counseling. There's the Ryder Bar. It might look like it's not open but I have a very reliable source who I can see was holding up an open sign. So when I get into patient care, there's-

- You really get into it.

- There's no slowing me down, there's no slowing me down. Anyway, I wouldn't say this is real typical because it's hard to get a lot of people to name five situations. But this is what the completed form would look like. And so that's basically it. Those are three easy-to-use forms. Each one is sampling something different. One's about handicap, one's about real listening in real world situations. That's the APHAB. And then the third is your own personal things, and I'm talking about listening situations.

But it could be some people just wanna be able to hear the doorbell. So that's the beauty of the COSI. The person designs it exactly for them and it's like a contract.

And in fact you can say, okay, if I can help you on these five situations, do we have a deal? And the person usually goes, "Yeah, now that would be great." And it's just a real nice way to facilitate counseling. Patients like it 'cause it shows-

- I agree 100%. I've used it myself many times and it's a great tool. So can't recommend it enough.

- Good, that's about it.

- That concludes our 3.3. So I'll see you for the next one, hopefully soon.

- Okay, whenever that may be. Talk to you later.

- All right, bye-bye.

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The Importance of Pre-Fitting Testing

- [Brian] Welcome to another Research Quick Takes. I'm Brian Taylor and today is episode 3.4 of "The Hearing Aid Fitting Process and Getting it right." And today we're gonna be talking about the importance of pre-fitting testing. And with me today is Gus Mueller. Welcome back, Gus.

- Thank you. Thank you. I'm looking forward to this topic. It's always sort of been a favorite of mine and partly I think because over the years it seems to be a little neglected. You know, if for those of you who listened to our previous Quick Takes, we talked a little bit about the new APSO standard. I say new, it's a year old now. So I thought that we'd start things off just by looking to see what the standard said. Keep in mind, as we've discussed before, the standard is what is the minimum. What's the minimum. So here's what the standard says. Pre-fitting testing includes assessment of speech recognition and noise, frequency-specific loudness, discomfort levels, other validated measures of auditory and non-auditory abilities are considered.

And when you think of the other ones, there's quite a few. And Brian, I know you've written about all this, probably each one of the nine of them that are there. And I think today, I think we decided that we would just talk about the ones that are listed in the standard rather than go through all nine of them. And that's the-

- That's the plan.

- That's these two here. But, you know, there's a test out there for each one of these that we're talking about, including perception versus performance. That was Gabby Sanders, I believe, who did the performance-

- [Brian] PPT.

- PPT, yeah and PPDIS and all those good things. Anyway, we'll stick with the two that we have circled here. I know that you've written a lot about the QuickSIN, Brian, in fact, were you working with Mead when this was developed?

- Well, I was in a clinic that shared an alley with Etymotic Research and so, yes.

- Oh, okay.

- Mead would pop in from time to time and I ended up doing an awful lot of the early testing when they were developing the QuickSIN.

- Well, that's what I thought. Well, it was first the SIN and then became the QuickSIN, so...

- Right, and it gets the name QuickSIN for a reason and that's because it's got, for each block of sentences, it's sort of pre-programmed at six different signal-to-noise ratios. So all you need to do is start testing at a loud MCL, 70 or 75, establish that, and then the test sort of takes over and it starts at a very easy signal-to-noise ratio, plus 10. And in five dB increments makes the signal-to-noise ratio more and more unfavorable. And so you just-

- Plus 25, actually.

- I'm sorry, plus 25, you're right. And it moves down in five dB steps to zero.

- Yeah, I had 25. You can't really even hear that there's a noise.

- Right, so it's such a positive signal-to-noise ratio. Anyway, it's easy to score. Here's an example of one list. The patient repeats the sentence, you score the underlying

words correct. You see the score there on the right margin, you write down the number of words that they say correctly. You can see in this example the X's are the words the patient didn't say. You total those up, you subtract that number from 25.5 and that gives you the patient's unaided signal-to-noise ratio loss. And then if you look at the bottom of this slide you can see kind of how it breaks down as far as the degree of SNR loss. If somebody scores between zero and three dB that would be considered near normal or normal.

Four to seven dB is mild. A mild SNR loss. 8 to 15 is moderate and then greater than 15 would be severe. So that kind of gives you a breakdown as far as what the different levels are of dB SNR loss. And of course, if I failed to mention, the test is done in the unaided condition, typically under earphones, one ear at a time.

- Yeah, exactly. And you know, the SNR loss thing, some people get lost on that, but what that basically means is how much poor is this person doing than someone with normal hearing. Someone with normal hearing does not get all the words correct. So that's why there's that scoring method where you subtract from 25.5, you don't subtract from 30. People say, "Well, why don't you subtract from 30, if there's 30 keywords?" But in this case we subtracted 19 from 25.5 and you get an SNR loss, which means for that person to perform normally, if they were sitting in a restaurant with somebody with normal hearing, you would have to turn the noise down six and a half dB for them to do as well with the person with normal hearing. That's the way I try to explain it to a patient.

- Right, and that's what makes the test so valuable I think, is to get that metric of a common situation where communication breaks down.

- Yeah. Speaking of the metric and how you use it in counseling, here's, Brian, you and I just sat down and here's a few things we said, if I were working in a clinic right now,

which unfortunately neither one of us are, but we both have at one time or another, how could you use this? And their list probably is much longer than this, but it gives a lot of, as you were just saying, a lot of information for the treatment plan. I mean, if a person has an SNR loss of 12, you know, you and their goal on the COSI is to understand in the noisiest Irish restaurant in Bismarck, you better have a talk with them before they ever walk out the door 'cause it ain't gonna happen.

It ain't gonna happen. And I don't know how you would know that if you didn't have the QuickSIN results. Anyway, you'll see asymmetry that you didn't know was there before, that you don't see in pure-tones or word recognition at quiet, all kinds of information for counseling. When a person says, "They're not doing very well," you can go back and look at that score. People with normal hearing who come in and say they have, you know people love to use this term hidden hearing loss, but I wonder if everybody did the QuickSIN would it still be a hidden hearing loss because-

- Yeah, I know, it's right about that.

- It's only hiding because the right tests aren't done in many cases.

- [Brian] Right. And I think what you'll find in many cases it isn't hidden at all. Their QuickSIN score will not be normal. It also can sort of be a screen for central auditory processing. Not that that's your purpose, but in the QuickSIN the multi-talker babble is not babble, it's four individual talkers. And you can actually start listening to the background talker rather than the person who's talking. And if you don't have good central auditory processing you're in trouble.

- You know, I wanted to bring up Matthew Fitzgerald, I think he runs the hearing clinic at Stanford University Medical Center.

- [Gustav] Vandy grad.

- Yeah, see, he has data on almost 6,000 patients that have come through their facility. And one of the most striking things, and they do the QuickSIN on everybody, there are many, many patients that have a word recognition score of 100%, 96%, that do very poorly on the QuickSIN. And you would never know without doing this test, how poorly they do in background noise.

- I think when you look at all of his data that the question you would ask yourself is why am I doing speech testing in quiet at all?

- [Brian] Exactly.

- [Gustav] Why?

- I don't think they-

- In 1948 they said it was a good idea.

- Right.

- That's the only reason I can come up with, anyway, the final thing on here, and I, you know, all of you who are fitting hearing aids have probably had the patient who said, "You know, I came in here with a problem understanding in background noise, aren't you gonna test me in background noise wearing my hearing aids?" You go, "Nope, nope, I'm not gonna do that. You just leave." So it adds some credibility, that you're doing the test that goes along with the patient's chief complaint. All right, moving on to the second one then. And that has to do with getting the MPO right. And the obvious,

I'll just say it though, is that it has to be low enough so that loud sounds do not not exceed the patient's LDL and it has to be high enough so that you have headroom.

And to me, if you know the Goldilocks story, and who doesn't really, it's just like the porridge. You need to get it just right. Not too hot, not too cold. Why do you need to measure frequency specific LDLs as it states in the APSO standard? Here's reason number one, this is our results from Ruth Bentler and Laura Cooley from several years ago, 508 years. And I'll give you the quick version here is that for any given hearing loss, the range in LDLs is about 40 to 50 dB and only a third were within plus or minus five dB from average. The bottom line is you can't predict from average, you gotta test it. Second thing, here's a study that I did with Wu and Elizabeth Stangl from University of Iowa a year or so ago.

We took this particular audiogram and I plotted there on the screen the LDLs that are predicted by the NAL. Now you might not see this in your fitting software, but if you go to the standalone NL2 software, they have predicted LDLs. So what you see there are the predicted LDLs and you have that audiogram, which you would think of as a pretty easy to fit. What we then did is we plugged that into the software of the premium hearing aid of the six major manufacturers. It said, what did the manufacturers pick as the maximum output if I picked NL2 as the fitting method? Now this would seem to be pretty simple. You would think they would pick 100, 100, 105 and 105 because that's the NAL, well that didn't happen.

What you see here is what the six different hearing aids, what they really did pick and the NAL is in the center point. If you look down at the bottom, that manufacturer is picking 10 dB below the NAL, if you look at the top green line, that manufacturer's picking 15 dB above the NAL. So you're getting a 25 dB difference in the maximum output just depending on who is your favorite manufacturer. They can't all be right.

- It's a big spread.

- Yeah, but that's why the world needs us.

- Exactly, if you take-

- So what are we gonna do? We're gonna use these tools. These tools are available from the HARL website. We've talked about that in previous installments of Quick Takes. You absolutely need the loudness anchors and you need to use the instructions that go with the loudness anchors. I'm gonna go through this really quickly here because it's been published so many times, but your testing is frequency specific done under earphones. I would suggest doing the measurement the same time you're doing the routine diagnostic. By the time you finish air conduction, you know if that patient is a hearing aid candidate or not. They're already set up, they're already used to listening the pulse tones and then you have the data, if they choose to come back and purchase hearing aids.

You really only have to test two frequencies I think per ear. You sort of want a lower and a higher boundary and only test where you're gonna be amplifying. If there's no loss of 500, you're doing an open fit, don't test at 500. You do an ascending method, either two or five dB steps, depending on how accurate you want to be on a given day. You keep going up, up, up till you reach number seven, you maybe do a second run to get reliability. And once you have that number seven value, you're ready to record that and move on to the next frequency. One of the biggest complaints that I hear from people saying, "Well, I don't do that because my patients are just all over the place and it isn't reliable."

That simply isn't true. Well, it would be true if you're not using the right anchors and the right instructions. That study has been done and the test-retest is 2.5 dB for LDLs,

which is the same for pure-tone thresholds. So if you're not doing LDLs because they're too unreliable, then you'd have to stop doing pure-tone thresholds too because the reliability is the same. Got anything on that, Brian? I got into just a little sermon at there. I couldn't-

- No, it's all right. I think that's valuable information. I think the next slide here where you talk about inverting from HL to SPL, I think some people forget that they have to do this.

- Yeah. Yeah, because you know, we wanna talk to the hearing aid and to talk to the hearing aid you use the manufacturer software and everything in the software is 2-cc coupler, not HL. So you have to use some second grade math and add what is called the RETSPL to the HL LDLs. And I did that with this example. So here's a patient, I tested two frequencies, 1,000 and 3k. At 1,000 his LDL was 92. I added the RETSPL, which was three, and I got 95 dB. Now I'm in the coupler. Okay, now I can talk to the software. Did the same thing at 3k and I get 107. So that's what I wanna program my hearing aids to. And what you see here then is, just coincidentally this happens to be Connexx fitting software, I simply went into the area where you program MPO and you use the handles down on the bottom, as most of you know, Connexx has a lot of handles.

You probably would only need about eight, I would say. Looks like there's maybe about 16 there, I'm thinking. But what you simply do is program the handles to get the values that you want. I have right here, at 1,000, I pulled it down till I got to 95. I then went up to 3k and pulled it down till I got to 107 I think it was what I wanted. And then I just programmed these other ones to give a nice smooth response. You just sort of interpolate and program them, once you got the key frequencies in there and you're ready to go. It's almost like a science. It's amazing. This is really sort of what separates fitting hearing aids from selling hearing aids.

- Well, and I think this is especially important to know, given the study that you talked about that you did with the folks at Iowa, because so many hearing aids don't provide enough headroom.

- Exactly.

- And you should do this.

- Yep. And so I can see why the APSO selected these two things, first of all to make Goldilocks happy, but also these are two things that the QuickSIN and getting the output right that are really going to impact your fitting. If you mess up either one of those you very likely could be in trouble.

- Yeah. So I couldn't agree more. Thanks for the valuable insights, Gus. It's good to-

- [Gustav] All right.

- Good to know that you're aligned with APSO.

- Hey, it's pretty easy. It's been written for 30 years so it's pretty easy to stay aligned. Alrighty. See you next time.

- See you next time.

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Verification of Gain and Output

- [Brian] Hi everyone, and welcome back to another "Research Quick Takes." I'm Brian Taylor, and today we're on episode 3.5: The Hearing Aid Fitting Process and Getting It Right. Today's episode, we're gonna talk about verification of gain and output. And as usual, joining me today is Gus Mueller. Gus, welcome to the broadcast.

- Yeah, one by one, we're making our way through this whole getting it right thing. And for a lot of people, verification is number one on the list of what you have to do. As I guess we've talked about, there's a lot of steps before you get to verification, but it certainly is important. So it's an easy one to talk about. On occasion, there's some confusion of when are you doing verification and when are you doing validation. You and I just talked the other day that we're gonna do an episode six, and episode six will be validation. And so today we're talking about verification, and I mean, this is used throughout industry, not just for fitting hearing aids.

When people are building something, creating something, they have a verification stage and a validation stage. To put it real simply is verification, are we building the system right? Meaning, did you program the hearing aid correctly? Validation means are we building the right system? Meaning, when you build it right and the person goes out to the real world, do they really get the benefit and satisfaction that you want? So today we're gonna talk about verification, which is, are we building the system, right? And in our last three episodes here of "Quick Takes," we've been pulling in the APSO Standard. Recall that this is what would be considered the minimum that you would do when you fit a hearing aid.

So I thought it would be good to see what they say. To no one's surprise, I guess, they say that various input levels of speech should be verified in the ear canal, meaning frequency-specific targets provided by a validated prescriptive method. Keyword, validated. There's basically only two out there that we use in the US, and you also then would look at the maximum power. Back in, I think, in episode 5.4, we talked about

getting the output program correctly. Well, now we're gonna verify to see if that really happens, and that's part of the APSO Standard. So that's what we're gonna talk about. So you need to start with a validated fitting approach, and these are five things that we know has to be part of a fitting approach.

And you could fiddle around in your clinic and try to get the best of each one of those five yourself. Or you could rely on really smart people who took all these factors and put 'em into a pot and stirred them up, and with a little bit of cooking and maybe chicken broth, I don't know, they ended up with the NL2 and the DSL. Both of them have been around for 30, 40 years and been heavily researched, which is why we use the term validated. A lot of people say, "Well, I don't like the gain of the NAL, I use the DSL." Other people say, "I really don't like DSL, I use the NAL." Well, here's something for both of you.

What you have there is the gain that you would pick for the DSL or the NAL for five different audiograms. This is the work of Earl Johnson and Harvey Dillon, published in JAAA in 2012. And so what you see, first of all, is let's just look at 500 and above, 'cause that's mostly all we care about. And let's forget about everything above 4K. And we usually consider that plus or minus five is a reasonable window to be within. The point here is that when you do those things and you look at these five different audiograms and what gain you prescribe, you have to conclude that basically the DSL and the NAL are the same. Yes, you could nitpick and say, "Aha, I see one frequency where there's more gain for the NAL," or "Aha, there's one where I see more for the DSL," but basically they're the same. So we don't have to quibble about what prescriptive method to use. The NAL is certainly the most popular in the US for adults. Anything on that, Brian?

- No, I think that that's a really good point that, at least in my thinking years ago, this goes back to the '90s, the DSL always provided more gain than you needed for adults,

or what more typically what adults would want. But obviously though, as more and more research, as more and more data is collected, those formulas become more and more similar.

- Yeah, and I think some people, you know, who tried the DSL years ago, remember from 3.0 or 4.0 or whatever, you know, they haven't really even looked at 5.0, which was modified significantly for adults. So the DSL, the people, I think, are still sort of remembering DSL for children, which is a different algorithm. So that's also important, I think, to remember. For those of you out there doing probe-mic measures, which is the only way you can verify the fitting, I might add, you're familiar with this, but just to give you an idea of what you're gonna see on the screen for those of you who don't do this routinely, you have your patients' thresholds that have now been converted to ear canal SPL, you have your fitting targets, you have your input signal, and you have your measured LDLs that have now been converted to ear canal SPL.

Sample protocol, and I'll go through this very quickly. It's been published many, many places. There's nothing I'm gonna say that hasn't been said by other people. You pre-program things. Make sure you tell the probe software that whether it's an inexperienced or a new user or whether it's a unilateral or bilateral fitting. That's gonna change the targets. You need the patient positioned correctly, and you, by far, you know, you need to use a calibrated speech input signal. The most common used today is what's called the ISTS. It's available on all probe-mic systems. Every now I see people talking, sometimes on some of these face audiology Facebook pages I see people talking about doing live speech mapping.

There's one company in particular I think sort of promotes that it is not acceptable to use this for verification. If you're verifying the NAL or the DSL, you have to use the exact same speech spectrum that was used when it was developed. If you're using live speech, you know, well, there's a reason you don't whistle your pure tones when you

do air conduction testing. Let me just say that. It's not calibrated. So you're just, you're out on an island. I mean, if you wanna do it for fun and games and have Margaret talk to her husband, fine, but it's not a way to fit hearing aids. So you use inputs of 55, 65, and 75. You want to be within five dB of your targets.

The way you would normally do this is you start with soft, then you do 75, you do loud, and then conclude with 65. Usually you're gonna be very close, simply because 65 is halfway in between the two. And if you have the other two correct, you'll probably be correct. It doesn't always look this good, but when it does, you put it on a PowerPoint and make it part of "Quick Takes." That's what I say. This your goal. You have there the soft, average, and loud targets, and it's a very nice fit. Up on the top, the orange is the MPO, but we're gonna talk about that a little bit later, very briefly. Now this makes the assumption that because this is a standard, this is what everybody does.

A rumor has it that that's not true, and that there are alternative ways to fitting hearing aids. And my understanding is the most popular alternative is to use the first fit from your favorite manufacturer, called proprietary fittings usually. I put up here some data from Mike Valente, who compared proprietary fittings to NAL program, just to give you an idea of what you'd be seeing. The red lines at zeros on each one of those charts is the NAL targets. So you see for on the top, for soft speech, you are on average in the high frequencies 14 dB below the NAL. At 4K, you're 20 below. At 3K, you're 15 dB below. This is the miss from target, the mismatch.

Now this, of course, is one of only one manufacturer, but there's considerable data showing that you're gonna get this kind of mismatch or similar to it from most all manufacturers. Brian, I know you, you know this literature.

- Yeah, I mean, it's really an important point because, well, 14 dB average, that means there's quite a few that are worse than that.

- Yeah, well, and you can actually see, actually you can see if, well, I can see because I'm looking very closely, but at 3K there were some people who missed by 25 dB at 3K, I'm lucky there's a spread of it is on there. So yeah. And one might ask, "Does that affect intelligibility?" And here's an interesting study. I know Brian, you've talked about this before in some of your presentations.

- Well, I know this is some data that comes from Ron Leavitt's clinic in Oregon, who I guess not only does he fit a lot of hearing aids, but he cleans up a lot of fittings from other people that were underfit. And that's what this kind of shows you. It looks at the relationship between audibility and speech intelligibility, and noise as measured on the QuickSIN. So notice on the X axis you have the SNR loss, and the more negative the number, the worse the person performs in background noise. And you look on the X axis, and you see six different hearing aids, a different hearing aid from each of the six major manufacturers. And then you see on the far left, or the far right, I should say, an old hearing aid, I guess maybe a 10 or 15-year-old hearing aid.

And you see there that's sort of, that kinda gives you a frame of reference. But those black bars are showing you the aided scores on the QuickSIN for the proprietary first fit. And the bottom line is the speech has to be about 10 dB or more greater than the noise for that person to be able to hear the conversation effectively. Well, for each one of those six fits hearing aids, when you simply program it to the NAL target and verify that you are close to the target with your probe-mic, look how much you've improved the ability of the person to hearing background noise. Take, for example, hearing aids three and four with the proprietary fitting, the signal to noise ratio's 16 dB, and you've changed it just by simply doing the right type of programming with the same hearing aid down around five.

That's a pretty dramatic improvement. And then you can see how it relates to the old hearing aid, where you're getting scores that are on par, maybe a little bit better than the old hearing aid and noise. Gus, I don't know if you had any more to add.

- No, no, no, that's exactly the whole point here. The one thing that always strikes me is that when you program the hearing aids correctly, notice that they're essentially all the same. Notice when you use proprietary, there's bigger differences. But also notice that no matter whose proprietary system you use, it's pretty bad, you know? So a lot of times, when somebody finds out I'm an audiologist, they go, "What brand of hearing aid should I buy?" The answer that I always say, "It's not the brand, it's whoever does the programming." And this goes to show the differences between brands are about two dB. The difference between how you program it is 10 dB. That's huge. That's huge. So why not program it correctly?

There's a concept. Okay, moving on to concepts. Brian just mentioned audibility, and so that's a second thing that we need to think about. You wanna fit the target, but at the same time, you can't forget the goal of obtaining good audibility. This is just an example using the world-famous, possibly galaxy-famous, count-the-dot audiogram, and there's a hundred dots there, and that's a very simple way to calculate a rough SII. But just to illustrate for you, what happens here is, I just took two different aided audiograms, one probably proprietary, one probably the NAL, and notice that the SII goes from 45% to 80%. Here's something, this is a slide that I got from Lori Zitelli at the University of Pittsburgh which tells you how bad it can get and how good it could get.

This was a patient that walked into their clinic looking at the left-hand sign who, I'm guessing, had been fitted to somebody's proprietary fitting. Notice that from 2K and above, basically there's no audibility. Even the peaks of speech are not audible, certainly not the LTAS. Lori sat down and, within five minutes or so, had the fitting that

you see on the right. Audibility through 6,000 hertz. You know, that's unbelievable, the differences that we can make. I mean, we hear about all these things of hearing loss is linked to dementia and all that, and hearing aids might make it better. It's only gonna make it better if you give 'em audibility.

- Right, but you need to hear.

- Without audibility here, that hearing aid fitting on the left isn't really gonna do diddly, I don't think. So hopefully nobody's fitted that way anymore. Probe-mic manufacturers know that you're interested in audibility, and I think all of them now have some way of calculating it for you. This happens to be Verifit, and you see they have, I just did the right ear there, they have the unaided for soft was seven, that went up to 44% aided. And then we have for average inputs, it started out at 28 or 38, I guess it is, and moved up to 78% for aided. 78% is about as good as it gets. Speaking of that, I don't have a chart like this for adults, but the folks from Western University, the DSL folks have a chart like this for pediatric patients where you can take the pure tone average, which is a scale down on the bottom.

They have a sample patient here where the pure tone average was 52, and they go straight up onto their chart to this person who had an SII of 78%. And is that normal? Yes, that's very good. Notice it's actually even above the average curve. So they give you a range of based on naturally, the less the hearing loss, the higher the aided SII should be. But notice if a person has a pure tone average of 70, then getting an SII of around 55% or so is considered acceptable because you're gonna reach the upper limits and there's only so much room to get audibility as the person's hearing loss gets worse. But this is a handy chart to determine if you're a good person or not when you're fitting pediatric patients.

And then I have just a few things here that have published in various articles of when you might have to back off on audibility, and these are pretty straightforward and pretty obvious. It could lead to feedback, and then the patient's gonna turn down all the gain. It could lead to things being too loud, and the patient will turn down all the gain. It could be an unacceptable sound quality, or remember all of our discussions 10 years ago or so about cochlear dead regions? You don't hear much talk about 'em anymore, but I think they're still dead. I don't think they came back to life. So they tend to cause unacceptable distortions, and sometimes audibility actually makes things worse. So these are things you have to think about before you pump in. Anything on that, Brian, from you?

- No, I think that it's good to remind people of some of the limitations, but at the same time, that's why-

- You know it's tempting when you see an SII of 72 to say, "I'm gonna get it up to 80 and things will be better." Well, maybe not. There's a reason why that when you program it to the NAL or the DSL, you're gonna end up with an SII around 70 to 75 for average inputs in most cases. All right, our final thing here is that you also have to verify the output, and that's simply done by running a swept tone at 85 dB, and you should see something that looks like this. You want it to fall just below the patient's LDLs. And no, we didn't do LDLs at all those frequencies. We just did it at three and then filled in all the other ones just to make the slide look pretty, and it does look pretty damn good, I think.

So that would be your final step in the overall verification. So you fit to targets, soft, average, and loud. You check for audibility to make sure audibility is good, and at the end, you check for the maximum output. You do those things, and you should give yourself a nice big check mark.

- Yeah, and the APSO Standards say all that. They recommend those but you-
- Exactly. Just precisely, yeah. We're pulling this right off the standard. So this isn't like a Gus and Brian; here's what we think is good. It's what a group of many audiologists believed was the minimum that should be done today when we're fitting hearing aids. And, you know, I mean, we need to separate ourselves from aisle seven of the neighborhood pharmacy, and I don't know how else we do that except by doing very good verification.
- I couldn't agree more.
- So, all right, well, you know, I'm thinking that we do one more of these since I already talked about validation. I say we go back to the drawing board, we sit down at our computers, get a beverage, and we write up something on validation, and come back and do one more.
- Sounds good. So I'll see you for 3.6 next time.
- Okay, sounds good.

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Validation of the Fitting

- Welcome back everybody, it's time for the sixth and final episode of Research Quick Takes 3: the Hearing Aid Fitting Process and Getting It Right. And today we're gonna be talking about validation of the fitting. And with us as always is Gus Mueller, welcome Gus.

- Hey, thank you Brian. It's been quite the journey that we've had here on volume 3, starting way back at the very early self-assessments, getting a plan of attack and working our way through testing, verification and now we're at the very final step, or the final step for what we're gonna talk about, which is validation. I'm betting that almost everybody out there really like their mom's chocolate chip cookies. And so when we're talking verification versus validation, I always like to tell the story, I actually have my mom's recipe. Normally, she didn't have a recipe for anything but I forced her one day sitting at the kitchen table to write down sort of what she does, and I've tried to make her cookies.

And, you know, when you're doing verification you're verifying putting in all the right ingredients and getting exactly the right measure baking them for exactly eight minutes at 375 and all these kind of things, that's verification. Validation is when you take the first bite, and unfortunately, mine never tastes like my mom's, but I've tried. So we're going back now, let's see, we're gonna approach this validation thing in two different ways. We're gonna be biting a lot of different cookies. We're gonna talk a couple things that you can do on the day of the fitting, before you send the patient home, and then we're gonna talk about some outcome measures that you can do later when they come back after, three, four weeks of hearing aid use. So we talked about the QuickSIN, Brian, back in 6.4

- [Brian] 3.4.

- 3.4, I mean, yeah and sort of how to do it, that was under earphones as a pre-fitting test. Now, we're gonna do something different. So I'll let you explain this procedure.

- Well sure, I like to think of the QuickSIN as kind of the Swiss army knife of the audiology world because it does a lot of different things. It's really a handy test. So no sense in getting into the details here because we talked about this in an earlier episode of volume three, but just know that it's prerecorded, each list of sentences, each block of sentences has a six different is recorded at six different signal-to-noise ratios. And as Gus said, during a pre-fit procedure, you would do this under earphones or headphones. But when you're validating a fitting, on maybe the day of the fitting, you can do the test in a slightly different way in the sound field where you test it at a softer intensity level.

So kind of explained here on this slide where you put the patient in the sound field and you would measure, have them seated about a meter away from the speaker where the speech and the noise are coming from the front. And you'd want to make sure that your audiometer dials around 35 or 40, that's gonna be soft speech, depends a little bit on the calibration, but I would aim for 40 dB HL. I'll have the patient seated in the sound field and the speech and the noise are gonna be coming from the same direction in front of the patient. And then you're simply gonna have the patient in the unaided condition, repeat the sentences, and find the SNR loss score on the QuickSIN, and then you'll repeat that same procedure at the same intensity level in the aided condition and do exactly the same thing. And then you have a really nice comparison of QuickSIN scores, unaided versus aided.

- Yeah, and you know, one thing, Brian, is that for people who are maybe doing more mobile audiometry and and mobile hearing aid fitting in that, you really don't need a test booth. The beauty of the QuickSIN is it's the SNRs are prerecorded you know, so if you had the CD, which is easy to get, you could put that on some kind of a portable

player and all you'd need is to calibrate the signal, which you can do with your smartphone and you can calibrate the level that you want an SPL and you could do this in a quiet office if you wanted to.

- [Brian] Exactly.

- I mean, it wouldn't be as precise, but for counseling purposes, I think it would be good enough.

- I think you're right.

- You'll end up-- Either way, you should end up with a chart something like this.

- Right, so here you get a typical result using that procedure we just explained for somebody with a milder hearing loss. So remember when you do the QuickSIN, you first start at an easy signal-to-noise ratio, that's on the right side of the graph, plus 25 and plus 20. And you can see there because this person has a milder hearing loss, even though you're testing at a relatively low intensity level, you get a pretty good percent correct score in the unaided condition. And then if you go all the way to the left-hand side in the most challenging or the most adverse signal-to-noise ratio, you can kind of see how both in the unaided and the aided condition things are pretty bad.

But what's interesting is sort of what you get in the middle, which are the most common signal-to-noise ratios that people typically are in, and you can see just how much improvement by restoring audibility you get when you measure the QuickSIN. So I find this to be a really handy counseling tool because you're measuring something that's very relatable to the patient and you're showing them just by restoring audibility basically how much improvement they get in background noise in some of the most

common kinds of listening conditions. One thing I forgot to mention, Gus, and maybe you can chime in on this is I know that on the QuickSIN, we measure SNR loss, but here we're showing a percent correct. So maybe talk a little bit about how you get that score.

- Yeah, well it's back on that procedure page that we went through fairly quickly, but you're always gonna do two lists and there's five key words in each sentence and there's six sentences. So that's what you see down on the bottom are the six different levels of the sentences. But, so there's five keywords, but you're doing two lists, which means that there's 10 keywords. So you simply calculate percent correct, that's all you do. You look at the five keywords on list one, five keywords on list two, four SNR plus 25. In this case, it looks like in the aided he got five correct on both, that's 100%, and then you just go level by level and calculate percent correct. One other thing, aside from pointing out to the patient where they're getting the benefit-- First of all, after you do the aided, the patient will almost always say, "Oh, geez I did a lot better."

They know right away that they're doing better which is the shot in the arm that they need. It's also handy to keep this chart handy, so that when they come back in two weeks later and say, "These hearing aids really aren't working in background noise." You can sort of go, "Whoa, whoa, whoa, wait a minute, do you not remember the the test that we did that showed they work really well in background noise?" Your patient is probably talking about a restaurant that had a signal-to-noise ratio of zero which is then you point out that circle down there for the signal-to-noise ratio and say at zero and say, "But you know what? Normal hearing people don't understand at that level either," which is true.

So anyway, second thing you do on the day of the fit is just to make sure that loudness is okay. You're gonna go back to that same loudness chart that we used back that we talked about when you're doing it by earphones, now you're doing it aided bilaterally.

Excuse me, this is pretty simple. Again, we're talking here in SPL. So if you're doing this with your audiometer in a test booth, you need to know what dial setting equals what SPL, depends on how your speakers were calibrated. So I would run a quick check to make sure you know what level you're using. Roughly, there's a 15 dB difference, but it's not always, sometimes it's 12, sometimes it's 10. So you basically deliver soft speech and hopefully you get a rating of one, two, or three, then you deliver average, then you did deliver loud.

The goal is, as you present these different levels, the patient is rating the loudness that they should. This almost always is a hit, hit, hit, the only way it wouldn't be, is if the hearing aids weren't programmed correctly. And then soft sounds will probably be inaudible, but hopefully this is just a nice validation that everything's working fine. We're now gonna move into part two of this. And this is what you do after the person comes back from using the hearing aids for several weeks and there's some questions you want answered. How did the intervention work? Did it improve communications ability? Did it improve lifestyle and did we meet our goals? And we have three different outcome measures that answer each one of those four questions.

And I might mention that if you choose not to ask your patients how they're doing, they'll find out a way to tell the world. They know how to use Google and they know how to go to Healthgrades and score you. So why not ask 'em yourself? That's my approach. We're going back to the good old COSI that we talked about a couple episodes ago. It still is a blank sheet right at the moment and we still do everything the same as we did before. We identify specific areas. we encourage the patient to nominate these situations that occur frequently. They rate the importance, but now the one thing that's different now that they've been using the hearing aids, we have them rate the degree of benefit and that comes up right here.

Here's our same guy, we brought him back three weeks later, and now we're looking to see how he's doing. Fortunately for us, for the ones that what he rated most important is where he's getting the most benefit, doesn't always turn out that way. He's not getting a lot of benefit for shooting pool, but we didn't really think he would because that's a really difficult listening situation. All in all, I would consider this a a successful fitting and you now can use this for whatever counseling purposes you like. And 'cause the idea here is we have looked at-- We have five specific things for that patient and we know how they're doing for each one of these five. It's like you, you signed a contract with them and I would say in this case you delivered. Brian, your thoughts on that?

- No, I think it's just a really handy tool that allows you to work in a collaborative way with the patient. So, you know, I think it's kinda one of those things that doesn't--

- Doesn't always turn out this good, but it really leads to good post fitting counseling, even when it doesn't turn out so good, you try to talk about why and what you perhaps can do to make things better, and do they have realistic expectations? That takes us to the second test, the APHAB, this is another one that we described back when when we're talking about pre-testing. So if you did it at the pre-testing, you already have the unaided results for this. Just to refresh your memory, to get the form you simply go to the HARL Memphis website, their hearing aid research lab. You click where that red arrow is and you can download the form, the scoring software everything you need, just to give you an idea of how you might use it in your clinic.

Down on the bottom we have ease of communication, reverberation, background noise and aversiveness, that's how much is this person bothered. And I plotted the scores of a sample patient, actually it was that patient I was just showing you the COSI results for. And what we see now is we see how the performance goes with the average person using hearing aids. Okay, and so what you see, this person, it might be a little

hard for you to see, but roughly they're around the 35th to the 65th percentile. So this person is doing what we'd expect for the average person using hearing aids. What you also can do, which is sort of fun is we have APHAB data for older people who have normal hearing.

And so what you see here is for that-- This is that same patient, what you see is that when we compare it here, we're seeing some-- We're seeing that for a couple conditions, they're doing in the 50th percentile of people with normal hearing. In background noise, they're still in the 80th percentile of people with normal hearing and so this is good counseling information. When people are saying these hearing aids don't work, you have something to come back and say, "Well let me tell you something, you're really performing about what we'd expect with someone with normal hearing," which is hopefully something that patients want to hear.

- I think that's a great counseling tool to really show people how they--

- And Brian, I know you've done some writing even some research I think using the IOI-HA. So I'll let you walk through this.

- Yeah, I have some familiarity with it. It's one of my favorite outcome measures because it's so simple and it gives you a lot of, I think, you know broad information about patient outcomes. It's only seven questions available on the that Memphis website that you just showed developed by Robyn Cox and her team about 15 years ago. Because it's only seven questions, it's really easy to administer and score. It's available in a ton of languages. And you can see here on this slide, what are the seven different outcome domains and benefit from hearing aids, daily use, satisfaction, residual activity limitation, participation restrictions. And there's even a question about the impact that the fitting might have on quality of life. So I know more and more

people are concerned about is metrics around quality of life and with the IOI-HA, you have at least one question that directly looks at quality of life.

- Yeah, you know, the interesting thing about this is, of course, each one of those seven, there's probably a whole questionnaire of 20 or 30 questions on that one domain. And in the development of this, it's all been condensed down to one question for a given domain just to facilitate it. And you mentioned different languages, here is actually a list. Well, that first of all, on the right you see the actual chart itself with the seven questions, very easy to administer and score, and then there's the list of all the translations. When I first saw this come out, I was a little concerned if they had included every foreign country. And then to my pleasure, I did see that it has been translated into North Dakota. So I look at the questions and when I do the North Dakota one I make sure I get that. I don't know what you use in Wisconsin, but we use the North Dakota version, Brian.

- Well I guess it'd be the equivalent would be used here too and--

- [Gus] Yeah

- I'm hoping your wife who's an audiologist who's using that version as well in your clinic.

- Oh, I'm sure she does. I think, you know, I think a question would be when you can't hear something, do you still just go sit in the corner and go, oofa? That could be one of the questions.

- That's the eighth question.

- You know, I actually haven't looked closely at the North Dakota version, that might be the Minnesota version, I don't know. Well, you, well how about telling us how we interpret this thing?

- That's a good question. I think off the top of my head, I think the the hashed out areas, those the norms, where you--

- Yeah, I think that's considered anything in that region is okay.

- So, you know, of course, if it was an individual person it's either gonna be a three or a four. But if you were collecting data for your clinic, then you may add up with a 3.7 or a 3.2 or whatever.

- Right, so if somebody, if the X, which represents the individuals and score from the individual on each of the questions, falls in that hash area, shaded area, that would be a good thing, very normal.

- [Yep, that would be a good thing, that would be good thing and then--

- [Brian] But what's interesting, I see here 6 outta 7--

- There only one rating.

- Right?

- That wasn't so good and that's this impact on others is what that stands for that IOTH, impact on others. I was actually wondering, you know, what happened here? Why was everything good and this wouldn't what's down? I went and actually looked up that particular question and it was over the past two weeks with your present

hearing aids, how much do you think other people were bothered by your hearing loss? And he rated that bothered quite a lot in number two, which is what puts him down there and who knows what's going on there, you know?

- Well, that's the great thing about a tool like this is you find out that they're below the norm and now you have something to target, to talk about, try to figure out why it's there and put together a plan to try to bring it into the shaded area.

- Yeah, yeah, exactly and, of course, if all of his other ratings of benefit and satisfaction were twos, then it would make sense that others were still bothered. But he's getting the benefit. He's getting the satisfaction. So you're saying, well he must be using them 'cause the use is actually high. So why are these other people still bothered, and who knows? Maybe it's a dysfunctional family, I don't know. But you can it's certainly something you can talk to the patient about.

- [Brian] Right.

- Well, and I think we're gonna-- Actually, we're gonna close up this 3.6 with a helpful tip. I think this came from some market track research from way back when, and that was research actually is shown, if you asking a patient if they're satisfied, improves their satisfaction by 7%, so--

- Well, that kind of makes sense just by taking the time to ask somebody. It means that you care enough that you wanna know their opinion and that's gonna drive satisfaction to a little bit higher number, I think

- There is a reason that every time you order something from Amazon, two days later you get a satisfaction survey, hoping that maybe you'll be 7% more satisfied with whatever you purchased.

- Right.
- So that's it.
- So with that, that concludes research quick takes volume 3, six episodes.
- What a deal.
- Thank you, Gus. It's been a pleasure working with.
- Will there be a season two or we might just wrap on six episodes?
- Yeah, this season's over, but our series is not gonna be canceled.
- Good, good.
- And there'll be a volume four sometime in the near future, so stay tuned.
- All right, well I'll be looking forward to it.